REMARKS

Claims 165-371 are pending in the instant application. Claims 171-182, 225-236, 279-290, 328-330, 333-335, 338-340, 343-345, 348-350, 353-355, 358-360, 363-365, and 368-370 are withdrawn. Claims 165-170, 183-224, 237-278, 291-327, 331-332, 336-337, 341-342, 346-347, 351-352, 356-357, 361-362, 366-367, and 371 stand rejected, including independent claims 165, 209, 219, 263, 273, and 317. Upon entry of the present amendments, claims 327, 331-332, 336-337, 341-342, 346-347, 351-352, 357, 361-362, 366-367, and 371 will be cancelled. Several of the claims, including independent claims 165, 209, 273, and 317, stand rejected under 35 USC § 101 as being directed to non-patentable subject matter. Several of the claims, including independent claims 165, 209, 219, 263, 273, and 317, stand rejected under 35 USC § 112, second paragraph, as being indefinite. Independent claims 165, 209, 219, 263, 273, and 317, as well some dependent claims, stand rejected under 35 USC § 103(a) as being unpatentable over the combination of Sandretto in view of Pang. The remaining claims stand rejected over combinations of Sandretto, Pang, Erlach, Huneault, Lipton, and Sant.

Applicant has amended the independent claims to further define the claimed subject matter, so as to advance prosecution of the application towards allowance. In the following remarks, Applicant explains that the subject matter of applicant's claims is patentable in view of the references of record. Should the examiner have questions or concerns, or if it would otherwise be helpful to advancing prosecution of the present application, the examiner is invited to call Applicant's undersigned attorney at (206) 332-1380.

Claim Rejections – 35 USC § 101

Claims 165-170, 183-218, 327, 331, 342, 346, 357, and 361 stand rejected under 35 USC § 101 because the Office states that the claimed invention is directed to non-statutory subject matter. Official Action, at 3. Specifically, the Office states:

> According to the recent Guidelines issued by the Deputy Commissioner, in order for a method claim to qualify as a patent eligible process under 35 USC § 101, the process of the method claim must (1) be tied to another statutory class (such as a particular apparatus) or (2) transform underlying subject matter (such an article or materials) to a different state or thing.

In the instant case, none of the process steps of the method claims 165 and 209
are tied to an apparatus such as a computer. Accordingly, the claimed invention
fails to qualify as a statutory process under the Guidelines.

The applicant is requested to indicate where in the specification there is support
for the amended claim. Note: merely reciting a computer in the preamble does not
meet the aforementioned requirement nor reciting a nominal process such as
communicating data with a computer. See also, In Re Bilski (2008, 545 F3d 943).

Id.

Applicant notes that at the date of the present Official Action, 17 June 2010, the USPTO
had not developed guidelines in response to the Supreme Court's decision in *Bilski v. Kappos*.
At that time the relevant, most recently issued USPTO guidelines were *"Interim Examination
Instructions for Evaluating Subject Matter Eligibility Under 35 U.S.C. 101,"* dated August 24,
2009 ("the Interim Instructions"). The Interim Instructions stated that *"A process claim, to be
statutory under § 101, must pass the machine-or-transformation test..."* ("the M-or-T test").

The Supreme Court's subsequent decision in *Bilski v. Kappos* states that the M-or-T test
is not the sole test for deciding whether an invention is a patent-eligible process. On July 27,
2010 the USPTO issued *"Interim Guidance for Determining Subject Matter Eligibility for
Process Claims in View of Bilski v. Kappos"* ("the Interim Bilski Guidance") that acknowledged
this. The Interim Bilski Guidance presents factors to be considered when evaluating patent-
eligibility of method claims. It is submitted that, in light of these factors, claims 165-170, 183-
218, 327, 331, 342, 346, 357, and 361 are patent-eligible under 35 U.S.C. § 101.

Claims 165-170, 183-218, 327, 331, 342, 346, 357, and 361 are all computer
implemented. It is integral to the implementation of the invention described in Applicant's
method claims that they are all implemented on a machine. It is integral that Applicant's
invention is implemented on a machine due to both the volume of data typically required to be
analysed, and the speed with which this processing is required in a real-time trading
environment. The use of a machine goes beyond mere data gathering or a field-of-use limitation.

A significant technical effect or feature of claims 165-170, 183-218, 327, 331, 342, 346,
357, and 361 is that:

...a range of different securities can be evaluated within a single, unified and coherent framework, thereby leading to significant reduction in the computing resources otherwise required.

Instant Specification, at [0001];

In the case of this example, a single option pricing model that could parsimoniously fit option prices to observed market prices (i.e. explain the Black-Scholes implied volatility surface) would eliminate the need to run the second model with consequential savings in the required computer resources, a reduction in the possibility of modelling errors and faster processing times. In a real-time trading environment the latter two technical effects are particularly important.

Id., at [0003];

In the case of equity securities (for example, stocks or shares) a range of models are typically used in their analysis. These models include the Capital Asset Pricing Model, shown in FIG. 2, the Fama-French three factor model and the Arbitrage Pricing Theory. While in the case of debt-type securities a different suite of models is typically applied. For example, the Merton option-theoretic model or the reduced form model. In the case of the Merton option-theoretic model, applied in a risk neutral world, it is known in the art that the resulting probability of default estimates are not "real world" estimates. Hence a second model is then typically required to "map" the risk neutral default probability estimates to real world default probabilities, as shown in FIG. 3 and as, for example, applied by commercial service provider Moodys KMV.

Id., at [0004]; and

In summary, while there have been attempts to introduce a coherent framework for analysing different types of securities, or assets, to date none have been able to achieve a parsimonious and efficacious approach that results in a reduction in the databases, models and computing resources required by users.

Id., at [0010].

Hence, by using the invention described in claims 165-170, 183-218, 327, 331, 342, 346, 357, and 361, there is a physical transformation (a reduction) in the computing resources otherwise required to evaluate a range of securities.

Claims 165-170, 183-218, 327, 331, 342, 346, 357, and 361 are not directed to application of a law of nature. Neither do any of these claims involve a general concept, whose use in other fields would be pre-empted. Nor are any of these claims so abstract and sweeping as

to cover both known and unknown uses of the concepts, including performance without any apparatus. Nor do any of these claims cover all possible solutions to securities evaluation in a parsimonious manner.

In summary, it respectfully submitted that in light of the Supreme Court's ruling in *Bilski v. Kappos*, claims 165-170, 183-218, 327, 331, 342, 346, 357, and 361 qualify as a patent eligible processes under 35 USC § 101. Despite these remarks, in the present response, Applicant cancels claims 327, 331, 342, 346, 357, and 361 for other reasons.

Claims 273-278, 291-322, 323-326, 337, 341, 352, 356, 367, and 371 stand rejected under 35 USC § 101 because the Office states that the claimed invention is directed to non-statutory subject matter. Official Action, at 4. Specifically, the Office states:

> Product claim 273, for example, has in the preamble "A computer-readable medium having computer-executable instructions..." Applying the broadest reasonable interpretation to the claim, the instructions are not required to be stored in a non-transitory manner on the medium, resulting in claims directed at transitory signals. (MPEP 2106.01 I). Claim 317 has the same problem.
>
> Claims 274-278,291-316,318-322,323-326,337,341,352,356, 367, and 371 are rejected because they depend from their respective independent claim.

Id.

The Applicant has amended claims 273-278, 291-322, and 323-326 to exclude transitory signals. For example, Applicant has amended claim 273 to read, "A non-transitory computer-readable medium..." Applicant cancels claims 337, 341, 352, 367, and 371 for reasons other than the rejections under 35 USC § 101.

Claim Rejections – 35 USC § 112

Claims 165-170, 183-224, 237-278, 291-327, 331-332, 336-337, 341-342, 346-347, 351-352, 356-357, 361-362, 366-367, and 371 stand rejected as being rejected under 35 USC § 112, second paragraph, because the Office states that they are indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Official Action, at 4.

The Office states, "Claim 165 recites the limitation 'the rate of return' in the preamble. There is insufficient antecedent basis for this limitation in the claim. Claims 219 and 273 have the same problem." Official Action, at 5. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 165 recites 'the risk attributes' in the preamble. There is insufficient antecedent basis for this limitation in the claim. Claims 219 and 273 have the same problem." Official Action, at 5. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 165 recites 'the volatility of returns' in step 2. There is insufficient antecedent basis for this limitation in the claim. Claims 219 and 273 have the same problem." Official Action, at 5. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 165 recites 'the price per unit' in step 2. There is insufficient antecedent basis for this limitation in the claim. Claims 219 and 273 have the same problem." Official Action, at 5. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 165, step 1 has '...the rate of return for each security' where there is no prior step of calculating a rate of return for each security. Claims 219 and 273 have the same problem." Official Action, at 5.

Applicant respectfully disagrees. The introduction to the claim states that a rate of return for said securities is related to a price or value of said securities and risk attributes of said securities. The nature of this relationship is established by the steps of the claim. The rate of return for each security can either be an input to modelling this relationship, or be an output of this process. This is over to the user to decide. Various of the dependent claims describe specific embodiments that describe how this can be done.

The general concept that the rate of return on a risky asset comprises the risk free rate plus a risk premium is well known by those with skill in the art. The instant specification at [0037] describes how the expected rate of return on a security in excess of the risk free rate of return is the expected excess return for that security and that this is equal to the product of the risk exposures and prices per unit of risk for that security.

The Office states,

> Claim 165, step 1 has 'determining a risk premium incorporated in the rate of
> return... ' where it is indefinite as to what determining a risk premium means if
> there is already a risk premium in the rate of return. This is interpreted to mean
> determining a risk premium rate for each of the plurality of securities, wherein
> said risk premium rate is part of the calculated rate of return for each of the
> plurality of securities. Claims 219 and 273 have the same problem.

Official Action, at 5. Applicant respectfully disagrees that these claims are indefinite for reasons

similar to those described, *supra*, for the phrase "...the rate of return for each security" in claims

165, 219, and 273.

> The Office states,

> Claim 165, step 2 has 'designating that a price [sic] risk factor incorporated in the
> risk premium... is the volatility of returns' where it is indefinite as to how a price
> [sic] risk factor is designated if the price risk factor has first not been determined.
> A prior step of determining a price [sic] risk factor is required. Claims 219 and
> 273 have the same problem.

Official Action, at 5-6.

Applicant respectfully notes that the Office's reference to "price risk factor" should be to

"priced risk factor." Applicant respectfully disagrees that these claims are indefinite for reasons

similar to those described, *supra*, for the phrase "...the rate of return for each security" in claims

165, 219, and 273, and furthermore, the general concept that the risk premium for a risky asset is

the product of one or more risk premia multiplied by the sensitivity of that risky asset to each of

those risk premia is understood by those with skill in the art. Where there is a single priced risk

factor, which is the market factor, this model is known as the Capital Asset Pricing Model.

Where there are multiple market-wide economic risk factors that are priced, this model is known

as the Arbitrage Pricing Theory.

> The Office states,

> Claim 165, step 2 has 'designating that a price risk factor incorporated in the risk
> premium ... is the volatility of returns ...' where it is indefinite as to how
> designating occurs if volatility of returns is incorporated in the price risk factor.
> This step is interpreted to mean designating a volatility of returns based on the
> determined price risk factor for each of the plurality of securities, wherein the
> volatility of returns is part of the price risk factor ... Claims 219 and 273 have the
> same problem.

Official Action, at 6.

Applicant respectfully disagrees that these claims are indefinite for reasons similar to

those described, *supra*, for the phrase "…the rate of return for each security" in claims 165, 219,

and 273, and furthermore, the terminology used by Applicant is known to those with skill in the

art. The volatility of returns is not 'incorporated' in the priced risk factor, it is a priced risk

factor. Other priced risk factors could include other statistical attributes of returns, such as

skewness, or different factors such as liquidity.

The Office states,

> Claim 165, step 2 has 'designating ... is the volatility of returns, measured over
> discrete time, and that the price per unit of this risk factor is the same for two or
> more of the said securities; ...' where measured over discrete time is indefinite
> based on the function of designating. This is interpreted to mean that when
> determining a rate of return, the rate of return is over a discrete time period.
> Claims 219 and 273 have the same problem.

Official Action, at 6. Applicant has amended these claims to overcome the rejections.

The Office states,

> Claim 165, step 2 has '... the price per unit of this risk factor ...' where it is
> indefinite as to what 'price per unit' refers to (e.g. price/share). Also, it is
> indefinite as to how rate of return (factor or percent) relates to risk factor, if the
> risk factor is a price per unit. Rate of return is based on discounting net cash flows
> over time. How does a 'price risk factor' with a price per unit relate to a risk
> premium and a rate of return, where rate of return is discounted net cash flow over
> initial investment? Claims 219 and 273 have the same problem.

Official Action, at 6.

Applicant respectfully disagrees. As stated in the claim, the price per unit is the price per

unit of the risk factor. It is commonly understood in the art that where risk factors are priced,

then the rate of return for a security will reflect or incorporate a risk premium equal to the

product of its exposure to that risk factor times the "price" of that risk. This requires that the

price of risk be expressed "per unit" of the risk factor. In the art these concepts are commonly

applied to economy-wide priced risk factors such as GDP growth, oil prices and/or a stock

market index.

In the Applicant's invention, the rate of return for a security includes a security-specific risk premium in respect of each priced-risk factor. That security-specific risk premium is the product of that security's exposure to each priced risk factor times a risk premium or price of risk for each risk factor, wherein this price of risk is the same for two or more securities associated with an underlying asset.

The Office states, "Claim 165, step 3 has 'defining a model comprising data ...' where it is indefinite as to how data is a model. Claims 219 and 273 have the same problem." Official Action, at 7. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 165, step 3 has '...a model comprising data representing relationships ...' where it is indefinite as to how data represents relationships. Claims 219 and 273 have the same problem." Official Action, at 7. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 165, step 3 has '...relationships between the risk premiums...' where relationships is indefinite since this could be anything. This is interpreted to mean the risk premiums are different for each security. Claims 219 and 273 have the same problem." Official Action, at 7. Applicant has amended these claims to overcome the rejections.

The Office states,

> Claims 209 and 317 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP § 2172.01. The omitted steps are: 1) risk parameters are generated from the model, but no model has first been created; 2) the risk parameters have been 'estimated over a discrete time period' but no step of estimating the risk parameters over a time period is provided; 3) solving the model based on values specified by a user where the user has not yet provided values.

Official Action, at 7. Applicant has amended these claims to overcome the rejections.

The Office states, "Claims 209, 273, and 317 are computer readable media having where a computer or processor is required to carry out the computer instructions." Official Action, at 7. Applicant has amended claims 273, and 317 to overcome the rejections, and notes that claim 209 does not recite "computer readable media."

The Office states

Claims 219 [sic] is rejected under 35 U.S.C. 112, second paragraph, as being
incomplete for omitting essential structural cooperative relationships of elements,
such omission amounting to a gap between the necessary structural connections.
See MPEP § 2172.01. The omitted structural cooperative relationships are: Claim
219 is a system claim with memory, a user interface, and units. There is no bus to
connect the units together or to a network.

Official Action, at 7-8. Applicant has amended these claims to overcome the rejections.

The Office states,

Claims 263 [sic] is rejected under 35 U.S.C. 112, second paragraph, as being
incomplete for omitting essential structural cooperative relationships of elements,
such omission amounting to a gap between the necessary structural connections.
See MPEP § 2172.01. The omitted structural cooperative relationships are: Claim
263 is a system claim with memory and a processing unit, where a user specifies
values, but there is no user interface, no network, and no bus. Further, it is
indefinite as to what processing units are involved (see Fig. 5).

Official Action, at 8. Applicant has amended these claims to overcome the rejections.

The Office states,

Claim 263 is indefinite as to how generate risk parameters from a model where
the model has not been created (could be anything). Risk parameters over an
estimated time period is indefinite since the risk parameters are generated from a
model, therefore the parameters would have to be determined for a time period
unless the model provides specific time periods of already estimated parameters.
It is indefinite as to how the model is solved to the parameters equal values
specified by users.

Official Action, at 8. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 169 recites the limitation 'the expected default loss' in the
preamble. There is insufficient antecedent basis for this limitation in the claim. Claims 223 and
277 have the same problem. Official Action, at 8. Applicant has amended these claims to
overcome the rejections.

The Office states, "Claim 169 recites the limitation 'of another, debt-type security' in the
preamble. There is insufficient antecedent basis for this limitation in the claim. There is no debt
type security from which another relates to. Claims 223 and 277 have the same problem."
Official Action, at 8-9. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 169 recites the limitation 'the promised yield' the first step. There is insufficient antecedent basis for this limitation in the claim. Claims 223 and 277 have the same problem." Official Action, at 9. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 169 recites the limitation 'the excess return' in the calculating the excess return step. There is insufficient antecedent basis for this limitation in the claim. Claims 223 and 277 have the same problem." Official Action, at 9. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 169 recites the limitation 'the risk free rate of return' in the calculating the excess return step. There is insufficient antecedent basis for this limitation in the claim. Claims 223 and 277 have the same problem." Official Action, at 9. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 169 recites the limitation 'the exposure of each security' in the calculating the exposure step. There is insufficient antecedent basis for this limitation in the claim. Claims 223 and 277 have the same problem." Official Action, at 9. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 169 recites the limitation 'the product of the risk exposures' in the calculating a price per unit step. There is insufficient antecedent basis for this limitation in the claim. Claims 223 and 277 have the same problem." Official Action, at 9. Applicant has amended the claims to clarify that this is the sum of the products, which is a mathematical term known in the art.

The Office states, "Claim 169 recites the limitation 'calculating the excess rate of return' in the calculating the excess return step. There is insufficient antecedent basis for this limitation in the claim. Claims 223 and 277 have the same problem. ." Official Action, at 9. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 169 recites the limitation 'the other securities being analysed' in the calculating the excess rate of return step. There is insufficient antecedent basis for this limitation in the claim. Claims 223 and 277 have the same problem." Official Action, at 10. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 169 has 'parameters of interest' in the providing step where parameters of interest are indefinite as there is no limitation as to where the parameters of interest come from or how they are determined. Claims 223 and 277 have the same problem." Official Action, at 10. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 170 recites the limitation 'the relationship between the firm specific price' in the first step. There is insufficient antecedent basis for this limitation in the claim. Claims 224 and 278 have the same problem." Official Action, at 10. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 170 recites the limitation 'the rate of return (rk) on another class' in the second step. There is insufficient antecedent basis for this limitation in the claim. Claims 224 and 278 have the same problem." Official Action, at 10. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 170 recites the limitation 'the default loss on said securities' in the third step. There is insufficient antecedent basis for this limitation in the claim. Claims 224 and 278 have the same problem." Official Action, at 10. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 183 recites the limitation 'the real world distribution' in the first step. There is insufficient antecedent basis for this limitation in the claim. Claims 237 and 291 have the same problem." Official Action, at 10. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 183 recites the limitation 'the returns on the underlying asset' in the first step. There is insufficient antecedent basis for this limitation in the claim. Claims 237 and 291 have the same problem." Official Action, at 10. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 183 recites the limitation 'the real world probability' in the first step. There is insufficient antecedent basis for this limitation in the claim. Claims 237 and 291 have the same problem." Official Action, at 11. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 183 recites the limitation 'the expected mean, standard deviation ... ' in the third step. There is insufficient antecedent basis for this limitation in the claim. Claims 237 and 291 have the same problem." Official Action, at 11. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 183 recites the limitation 'the aforesaid parameters...the real world payoff' in the forth step. There is insufficient antecedent basis for this limitation in the claim. Claims 237 and 291 have the same problem." Official Action, at 11. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 183 recites the limitation 'the aforesaid parameters' where it is indefinite as to what parameters are required to calculate. Claims 237 and 291 have the same problem." Official Action, at 11. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 183 recites the limitation 'the expected option payoff' in the fifth step. There is insufficient antecedent basis for this limitation in the claim. Claims 237 and 291 have the same problem." Official Action, at 11. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 183 recites the limitation 'moments of higher interest to the user... for any other factors specified by a user... ' where it is indefinite as to why the user is not specifying other factors. Claims 237 and 291 have the same problem." Official Action, at 11. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 183 has 'parameters of interest' in the providing step where parameters of interest are indefinite as there is no limitation as to where the parameters of interest come from or how they are determined. Claims 237 and 291 have the same problem." Official Action, at 11. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 204 recites the limitation 'the portions of that distribution.' There is insufficient antecedent basis for this limitation in the claim. Claims 258 and 312 have the same problem." Official Action, at 12. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 206 recites the limitation 'the returns on the firm...' There is insufficient antecedent basis for this limitation in the claim. Claim 314 has the same problem." Official Action, at 12. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 185 has 'parameters of interest' in the providing step where parameters of interest are indefinite as there is no limitation as to where the parameters of interest come from or how they are determined. Claims 239 and 293 have the same problem." Official Action, at 12. Applicant has amended these claims to overcome the rejections.

The Office states,

> Claim 186 has the following antecedence problems: 'the real world distribution process'; the expected real world probability:; 'the mean, standard deviation ... '; 'the distribution process'; 'the time horizon of interest'; the aforesaid parameters'; 'the real world payoff'; 'the chosen evaluation date'; 'the price per unit of risk... ' Claims 240 and 294 have similar problems.

Official Action, at 12. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 186 has 'parameters of interest' in the providing step where parameters of interest are indefinite as there is no limitation as to where the parameters of interest come from or how they are determined. Claims 240 and 294 have the same problem." Official Action, at 12. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 187 recites the limitations: 'additional multi-variate equations ... '; '... the variables ... ' in the first step. There is insufficient antecedent basis for this limitation in the claim. Claims 241 and 295 have the same problem." Official Action, at 12. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 187 recites the limitations: 'the remaining unknown variables ... '; '... in the equations' in the second step. There is insufficient antecedent basis for this limitation in the claim. Claims 241 and 295 have the same problem." Official Action, at 12. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 188 recites the limitation: 'the unknown inputs... '. There is insufficient antecedent basis for this limitation in the claim. Claims 189-195, 242-249, and 296-303 have the same problem." Official Action, at 12. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 191 recites the limitation: 'the correlation between... '. There is insufficient antecedent basis for this limitation in the claim. Claims 245 and 299 have the same problem." Official Action, at 12. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 190 recites the limitation: 'the covariance between the returns... '. There is insufficient antecedent basis for this limitation in the claim. Claims 192, 244, 246, 298, and 300 have the same problem." Official Action, at 12. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 193 recites the limitation: 'the expected probability of default.' There is insufficient antecedent basis for this limitation in the claim. Claims 201, 247, 255, 301, and 309 have the same problem." Official Action, at 12. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 195 recites the limitation: 'the expected default loss...' There is insufficient antecedent basis for this limitation in the claim. Claims 249 and 303 have the same problem." Official Action, at 12. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 197 recites the limitation: 'the correlation between the returns...' There is insufficient antecedent basis for this limitation in the claim. Claims 199, 251, 253, 305, and 273 have the same problem." Official Action, at 12. Applicant has amended claims 197, 199, 253, and 305 to overcome the rejections, and note that claim 273 does not recite "the correlation of returns."

The Office states, "Claim 198 recites the limitation: 'the covariance between the returns...' There is insufficient antecedent basis for this limitation in the claim. Claims 200, 252, 254, and 306-307 have the same problem." Official Action, at 12. Applicant has amended claims 198, 200, 252, 254, and 306 to overcome the rejections, and note that claim 307 does not recite, "the covariance between returns" (though it does recite, "the correlation of returns").

The Office states, "Claim 202 recites the limitation: 'the expected loss given default.' There is insufficient antecedent basis for this limitation in the claim. Claims 256 and 310 have

the same problem." Official Action, at 14. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 203 recites the limitation: 'the expected default loss...' There is insufficient antecedent basis for this limitation in the claim. Claims 257 and 311 have the same problem." Official Action, at 14. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 205 recites the limitation: 'the portions of that distributio [sic] ...' There is insufficient antecedent basis for this limitation in the claim. Claims 259 and 313 have the same problem." Official Action, at 14. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 207 recites the limitation: 'the real world statistical distribution process...' There is insufficient antecedent basis for this limitation in the claim. Claims 261 and 315 have the same problem." Official Action, at 14. Applicant respectfully submits that the amendments to respective parent claims 186, 240, and 294 overcome these rejections.

The Office states,

> Claim 208 is rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP § 2172.01. The omitted steps are: there is no receiving step providing values for the parameters listed in the equation; there is no calculating step that determines values for the two equations. Further, if this is a transcendental equation, it is indefinite as to how the equation is solved (i.e. is an iterative process required). Claims 262 and 316 have the same problem.

Official Action, at 14. Applicant has amended the claims to overcome the rejections.

The Office states, "Claim 208 recites various parameters. For example: Sn is the value of the equity of the firm at time n. There is no antecedent basis for the value of the equity at time n. Other parameters listed have similar problems. Claims 262 and 316 have the same problem." Official Action, at 14-15. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 210 recites the limitation: 'the returns ... ' and 'the securities ... ' There is insufficient antecedent basis for this limitation in the claim. Claims 264 and 318 have the same problem." Official Action, at 15. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 211 recites the limitation: 'the correlation ... ' and 'between the returns... '' There is insufficient antecedent basis for this limitation in the claim. Claims 213, 265, 267,319 and 321 have the same problem." Official Action, at 15. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 212 recites the limitation: 'the covariance ... ' and 'between the returns ... ' There is insufficient antecedent basis for this limitation in the claim. Claims 214, 266, 368, 320, and 322 have the same problem." Official Action, at 15. Applicant notes that claim 368 does not recite, "the covariance..." or "between the returns..." (Applicant submits that perhaps the Office intended to refer to claim 268). Applicant has amended claims 214, 266, 320, and 322 to overcome these rejections.

The Office states, "Claim 213 recites the limitation: 'the returns of the total firm.' There is insufficient antecedent basis for this limitation in the claim. Claims 214,267-268 and 321-322 have the same problem." Official Action, at 15. Applicant has amended these claims to overcome the rejections.

The Office states,

Claim 215 is rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP § 2172.01. The omitted steps are: there is no receiving step providing values for the parameters listed in the equation; there is no calculating step that determines values for the two equations; there is no defining of the variables in the claim. Claims 215, 269-270, and 323-324 have the same problem.

Official Action, at 15. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 215 recites the limitation: 'the formula...' There is insufficient antecedent basis for this limitation in the claim. Claims 216-218, 269-272 and 323-326 have the same problem." Official Action, at 16. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 215 recites '...formula for calculating additional parameters... for calibration with the model comprise:...' two formulas are listed. There are two formulas (not formula), and it is indefinite as to how calibration is accomplished with the two formulas. Claims

216, 269-270 and 323-324 have the same problem." Official Action, at 16. Applicant has

amended these claims to overcome the rejections.

The Office states, "Claim 217 recites '...formula for calculating additional parameters...

for calibration with the model comprise:...' where multiple formulas are listed. It is indefinite as

to how calibration is accomplished with the formulas. Claims 218, 271-272, and 325-326 have

the same problem." Official Action, at 16. Applicant has amended these claims to overcome the

rejections.

The Office states,

> Claim 217 is rejected under 35 U.S.C. 112, second paragraph, as being
> incomplete for omitting essential steps, such omission amounting to a gap
> between the steps. See MPEP § 2172.01. The omitted steps are: there is no
> receiving step providing values for the parameters listed in the equation; there is
> no calculating step that determines values for the equations; there is no defining
> of the variables in the claim. Claims 218, 271-272, and 325-326 have the same
> problem.

Official Action, at 16. Applicant has amended these claims to overcome the rejections.

The Office states, "Claim 308 recites the limitation: 'the covariance between the returns

...' There is insufficient antecedent basis for this limitation in the claim." Official Action, at 16.

Applicant has amended this claim to overcome the rejection.

The Office states, "Claims 331 and 336 are hybrid claims. Hybrid claims occur when two

different statutory categories are claimed. For example, claim 331 is directed at a product, but is

part of a method claim. Claims 327, 332, 342, 346-347, 351, 357, 361-362, and 366 have a

similar problem." Official Action, at 16-17. Applicant has cancelled these claims in the present

response.

The Office states, "Claims 166-170, 183-208, 210-218, 220-224, 237-262, 264-272, 274-

278, 291-316, 318-327, 331-332, 336-337, 341-342, 346-347, 351-352, 356-357, 361-362, 366-

367, and 371 are also rejected because they depend from their respective independent claim."

Official Action, at 17. Applicant submits that present amendments and remarks regarding the

respective parent claims overcomes the present rejections under 35 USC § 112, second

paragraph.

Claim Rejections – 35 USC § 103

The invention described in Applicant's independent claims stand rejected as being unpatentable over the combination of Sandretto and Pang et al. In addition, some of the claims stand rejected over the combination of Sandretto in view of Pang in further view of Erlach et al, Hunealt, Lipton et al, or Sant.

In the following remarks Applicant focuses attention on the rejections based on the combination of Sandretto in view of Pang. As Applicant shows below, (1) this combination fails to teach certain important aspects of Applicant's claimed subject matter, (2) is also unsupported as lacking a rational explanation of why the combination would have been obvious, and (3) is improper for purposes of finding Applicant's independent claims unpatentable. As Applicant also shows below, the prior art teaches away from Applicant's subject matter and Applicant's subject matter produces unexpected results. For purposes of economy, Applicant has not presented separate detailed arguments in respect to the further combinations of Sandretto in view of Pang and further in view of either Erlach et al, Hunealt, Lipton et al, or Sant. However, Applicant respectfully and explicitly traverses all bases for rejecting the claims as set forth in the Official Action.

Claims 215-218, 269-272, and 323-326 stand rejected, in part, because the Office states that they recite limitations that carry no patentable weight as being non-functional descriptive material. Official Action, at 35-36. Applicant has amended the claims, and submits that the amended claims overcome the rejections.

Claims 204, 206, 258, 260, 312, and 314 stand rejected as being given no patentable weight due to intended use language. Official Action, at 35. Regarding claims 204, 258, and 312, the Office states, "Use of 'are expected to follow...' is intended use since the returns may never follow the specified distribution." Official Action, at 35. Applicant respectfully disagrees. The phrase cited by the Office is part of the term used in these claims: "the real world distribution process that the returns on the firm (or underlying asset) are expected to follow ..." Claim 206 is dependent on claim 204, which in turn is dependent on claim 183, and claim 183 provides the antecedent basis for this term. The first recitation of claim 183 is, "specifying the real world distribution process that the returns on the underlying asset are expected to follow."

Hence the use of the term "the real world distribution process that the returns on the firm (or

underlying asset) are expected to follow …" in claims 204 and 206 is not intended use language,

but a description of a model input. Similarly, claim 260 is dependent on claim 258, which in

turn is dependent on claim 237, and claim 314 is dependent on claim 312, which in turn is

dependent on claim 293. The same analysis applies to claims 258, 260, 312, and 314, *mutatis

mutandis*.

That *ex post* returns may never follow the specified distribution is irrelevant. What is

relevant to a user is the *ex ante*, expected distribution of returns. This concept of "expectations"

is well known to those with skill in the art.

I. The Claimed Invention

Applicant's Disclosed Subject Matter

As discussed in paragraph [0014] of the instant specification, the broad concept of the

invention is that two or more securities issued by, or referenced to, a firm (or other asset) share

exposure to the same underlying sources of risk and the price of these priced risk factors can be

analysed at the firm (or asset) specific level. In particular, in the case of the price of the risk of

volatility, measured over discrete time, of expected returns the price of risk (i.e. the volatility risk

premium) is the same for all firm (or asset) specific securities. Moreover, in the case of debt-

type securities the promised yield spread is analysed as comprising at least an expected default

loss component and an expected risk premium (or premia) component.

As discussed in paragraph [0083] of the instant specification, the invention differs from

other models known in the art, such as the Capital Asset Pricing Model and the Arbitrage Pricing

Theory, which latter models include a market-wide price of risk. The latter models are not based

on underlying asset specific measures of total risk, but rather are implemented by only pricing

the systematic or market correlated element of risk or risks.

As discussed in paragraph [0114], and illustrated in figure 8, of the instant specification,

despite the Black-Scholes option pricing model being based on the premise of a single volatility

input, the volatilities implied by market option prices and inverting the Black-Scholes model

differ across different strike prices - the so called "volatility smile" problem. As discussed in paragraph [0115] of the instant specification, a preferred embodiment of the invention provides a much closer fit to observed market prices across all exercise prices.

Applicant's Claims

The instant application includes two general groups of claims, each with three independent claims. One general group includes independent claims 165, 219, and 273, while the other general group includes independent claims 209, 263, and 317.

In the first group of claims, claim 165 is directed to a computer implemented method, claim 219 is directed to a system, and claim 273 is directed to a computer readable medium. Each of the independent claims in this group recites that a risk premium is incorporated in the rate of return for each security, that the price per unit of a priced risk factor is the same for two or more securities associated with an underlying asset and that a priced risk factor is the volatility, measured over discrete time, of returns. For example, claim 165, as currently amended, reads as follows (emphasis supplied):

> 165. A computer implemented method for relating a price or value of *a plurality of securities associated with an underlying asset*, a rate of return on said securities and risk attributes of said securities, the method comprising the steps of:
>
> determining *a risk premium incorporated in the rate of return for each security*;
>
> designating that *a priced risk factor incorporated in the risk premium for each security is volatility, measured over discrete time,* and that *a price per unit of this risk factor is the same for two or more of the said securities*; and
>
> defining a financial model representing at least one relationship between the risk premiums determined for each security, and
>
> storing the financial model in a computer memory.

Claims 219 and 273 include similar recitations.

In the second group of claims, claim 209 is directed to a computer implemented method, claim 263 is directed to a system, and claim 317 is directed to a computer readable medium. Each of the independent claims in this group recites an option-theoretic model of a firm,

generating risk parameters from the model, estimated over a discrete time period, and solving the model so that the value of these parameters equal user specified values. For example, claim 209, as currently amended, reads as follows (emphasis supplied):

> 209. A computer implemented method for applying an option-theoretic model of a firm comprising the steps of *specifying values for risk parameters*, determining a plurality of input parameters, defining relationships between said input parameters, creating *a computer implemented option-theoretic model of the firm*, inputting the input parameters to the model, *estimating one or more risk parameters from the model, measured over a discrete time period*, *solving the model so that the estimated risk parameters equal the values specified by a user*, and storing the solution to the model in a computer memory.

Claims 263 and 317 include similar recitations.

II. The Prior Art Cited in the Office Action

Claims 165-168, 185, 187-189, 191, 195-197, 199, 202-203, 209-222, 239, 241-243, 245, 249-251, 253, 256-257, 263-265, 267, 269-276, 293, 295-297, 299, 303-305, 307, 310-311, 317-327, 331-332, 336-337, 341-342, 346-347, 351-352, 356-357, 361-362, 366-367 and 371 stand rejected as being unpatentable over the combination of Sandretto in view of Pang et al.

Applicant notes that the Office has not provided any analysis of claims 212, 214, 320 or 322 over the combination of Sandretto and Pang et al., and submits that, as such, the Office has not established a *prima facie* determination of obviousness, pursuant to MPEP 2141.

In addition, claims 169-170, 223-224, and 277-278 stand rejected over Sandretto in view of Pang in further in view of Erlach et al.

In addition, claims 183-184, 204, 206, 237-238, 258, 260, 291-292, 312, and 314 stand rejected over Sandretto in view of Pang and further in view of Hunealt.

In addition, claims 186, 205, 207-208, 240, 259, 261-262, 294, 313, and 315-316 stand rejected over Sandretto in view of Pang and further in view of Lipton et al.

In addition, claims 190, 192, 244, 246, 298, and 300 stand rejected over Sandretto in view of Pang and further in view of Sant.

Sandretto discloses, as prior art, the capital asset pricing model (CAPM). Under this model the risk measure is "beta," which is multiplied by a market risk premium and added to a

risk free rate in order to arrive at an expected rate of return for an asset. Sandretto discloses that different risk premia can be used for different asset classes, such as US stocks or UK Treasury securities. Sandretto discloses a "default risk premium" for debt. Sandretto discloses correlation between variables, as an input.

Pang discloses a volatility calculator in an apparatus and method for pricing financial derivatives.

Erlach et al. disclose that a junk bond yield includes a default rate premium and that a required stock yield must incorporate a greater default risk premium.

Hunealt discloses topographical mapping of insurance in relation to options.

Lipton et al. disclose analysis of default in accordance with Zhou's model.

Sant discloses calculation of portfolio risk and return measures, one of which is the covariance of a pair of stocks in a portfolio.

III. The Rejection Under Section 103(a) is Improper

Applicant will now explain why the rejections under Section 103(a) should be withdrawn. As discussed below, Applicant respectfully requests that the Office consider four high-level reasons for overturning the rejections: (1) There are substantial differences between Applicant's claimed invention and the cited combination of Sandretto in view of Pang; (2) the prior art teaches away from Applicant's claimed invention; (3) Applicant's claimed invention yields unexpected results; and (4) the rationale advanced by the Office for rejecting the claims based on the combined teachings of Sandretto and Pang et al. is conclusory and legally deficient. Applicant respectfully requests that the Office reconsider the rejections.

<u>Differences Between the Claimed Invention and the Prior Art</u>

The Office states that "Beta is the volatility of the return," and also that "Sandretto teaches beta, he does not teach "volatility." Official Action, at 19. Applicant respectfully disagrees with the first statement. Beta is *not* the volatility of returns, and Sandretto does not teach this. Sandretto, rather, teaches beta in the CAPM context, as known in the art.

Sandretto teaches use of a market-wide risk premium, or a risk premium *for asset classes* (such as US stocks or corporate stocks). Applicant's invention teaches use of risk premia (or the price per unit of a risk factor) that are *specific to a single underlying asset* and the securities associated with that asset.

Sandretto teaches the use of *beta*, not volatility, as the priced risk measure. Applicant's invention teaches the use of *volatility*, measured over discrete time, as a risk measure.

Pang et al. teaches the use of an implied volatility calculator. Pang et al. states, "The basic framework of the forward pricing program is that of Black and Scholes..." Pang, at col. 5, lines 53-54. The Black-Scholes framework is that of a risk neutral world, that is there is no risk premium included in the Black-Scholes option pricing model. Pang et al. present several formula in the specification and in the claims where the rate of return used to calculate implied volatility is "r", which they define as the risk-free interest rate. Pang et al. do not teach use of *risk premia*, either on a market-wide or asset-specific basis.

Neither Sandretto nor Pang et al. teach the use of an option-theoretic model of the firm.

Where Sandretto teaches a "default premium" for debt issues or bond, no distinction is made between an expected default loss and a risk premium for such debt issues. In Applicant's specification and claims, this is an important distinction that is made in analysing all debt issues or bonds. Refer, for example, to the instant specification at [0037], and [0039], and claim 166.

Sandretto teaches the use of means, correlations and statistical distributions of economic variables as *inputs* to a system. By contrast, Applicant's invention uses means and correlations to *solve or fit* models. Furthermore, Applicant's invention can be practised using *higher statistical moments*, such as skewness and kurtosis, to *solve or fit* models.

Erlach et al. teaches incorporation of a default risk premium in a required stock yield. Applicant's invention does *not* incorporate a default risk premium in a required stock yield. Applicant's invention makes a distinction between an expected default loss and a risk premium when used to analyse debt-type securities.

Erlach et al. teach that *at-risk bonds cannot yield more than treasuries* in real, after-tax terms in the aggregate, and *after defaults* net of recoveries and related costs. Applicant's invention teaches that *risky debt-type securities earn a risk premium above a risk free rate* (such

as treasuries), after allowing for expected default losses. Refer, for example, to the instant specification at [0037], and [0039], and claim 166.

Hunealt teaches a method for the topographical mapping of investment risk. This mapping method is unrelated to Applicant's invention. Hunealt applies topographical mapping method to options, but in doing so merely uses the Black-Scholes risk neutral option valuation framework that is known in the art and referred to in Applicant's specification. Refer, for example, to the instant specification at [0003].

Lipton et al. teaches default using Zhou's model. This model is implemented in the Black-Scholes risk neutral framework. Lipton et al. uses a risk free interest rate (r) in its application, where it is variously referred to as "the risk free interest rate" (Lipton, at [0011]), "the risk neutral rate" (Lipton, at [0045] and [0065], and claims 1, 6, 11, 12, 22, and 32), and "the interest rate" (Lipton at [0103], [0113], and [0121], and claims 17, 18, 19, 26, 27, and 29). Lipton et al. does not teach use of risk premia, of volatility as a priced risk factor, or of expected loss given default.

Sant teaches analysis of the covariance between pairs of stocks as an intermediate step to calculating the variance of a portfolio. Applicant's invention is not directed to portfolio risk analysis. Applicant's invention uses the covariance between a security and the underlying firm to which it is referenced, or between pairs of securities referenced to the same firm in order to fit models.

Accordingly, for the reasons set forth above, Applicant requests that the rejection of the inventions described in the instant claims based on the combination of Sandretto in view of Pang be withdrawn.

The Prior Art Teaches Away

Sandretto teaches use of the CAPM, a model known in the art. The teachings of the CAPM model are that the total risk of an asset, as measured by its volatility, is not relevant for asset pricing. Instead it is only the *systematic* component of risk, as measured by beta, that is relevant for asset pricing. The rationale in the art is that by holding a diversified portfolio investors can virtually eliminate their exposure to *non-systematic* risk. It is taught that investors should not expect any reward for bearing non-systematic risk. Accordingly, it is submitted that

the CAPM prior art, as cited in Sandretto, teaches away from use of total volatility as a priced

risk measure.

In discussing the CAPM equation, Elton and Gruber, Modern Portfolio Theory and

Investment Analysis, 5th edition, 1995, states at 301:

> One of the greatest insights that comes from this equation arises from what it
> states is unimportant in determining return. Recall that in Chapter 7 we saw that
> the risk of any stock could be divided into systematic and unsystematic risk. Beta
> was the index of systematic risk. This equation validates the conclusion that
> systematic risk is the only important ingredient in determining expected returns
> and that non-systematic risk plays no role.

Additionally, in Brealey and Myers, Principles of Corporate Finance, international

student edition, 1981, states at 127:

> If we want to know the contribution of an individual security to the risk of a well-
> diversified portfolio, it is no good thinking about how risky that security is if held
> in isolation – we need to measure its market risk and that boils down to measuring
> how sensitive it is to market movements. The sensitivity of an investment's return
> to market movements is usually called its beta (β).

Pang et al. teaches use of the Black-Scholes option pricing framework, which is based on

an assumption of "risk neutrality." The teachings of this framework in the art are that it is

unnecessary, and indeed extremely difficult, to include a risk premium in the analysis of options.

The Black-Scholes prior art thus teaches away from inclusion of risk premia. The instant

specification at [0008] includes the following quote from a press release at the time two of the

three academics behind the Black-Scholes framework received Nobel Prizes in economics:

> The value of an option to buy or sell a share depends on the uncertain
> development of the share price to the date of maturity. It is therefore natural to
> suppose-as did earlier researchers-that valuation of an option requires taking a
> stance on which risk premium to use, in the same way as one has to determine
> which risk premium to use when calculating present values in the evaluation of a
> future physical investment project with uncertain returns. Assigning a risk
> premium is difficult, however, in that the correct risk premium depends on the
> investor's attitude towards risk. Whereas the attitude towards risk can be strictly
> defined in theory, it is hard or impossible to observe in reality.

In discussing the Black-Scholes option pricing formula, Brealey and Myers states at 440:

For our purposes the precise formula is less important than the terms that appear in it.

Notice that the willingness of individuals to bear risk does not affect value, nor does the

expected return on the stock.

Additionally, Elton and Gruber states at 589:

Perhaps the most interesting aspect of the Black-Scholes model is a variable that does not

appear as a determinant of the value of a call. This variable is the expected rate of return

on the stock.

Additionally, Chance, An Introduction to Derivatives, 3rd edition, 1995, states at 7:

While most individuals are indeed risk averse, it may surprise you to find that in
the world of derivative markets, we can actually pretend that most people are risk
neutral. No, we are not making some heroic but unrealistic assumption. It turns
out that we obtain the same results in a world of risk aversion as we do in a world
of risk neutrality.

Additionally, Hull, Opions, Future and Other Derivatives, 5th edition, 2002, states at 244-

245:

We introduced risk-neutral valuation in connection with the binomial model in
Chapter 10. It is without doubt the single most important tool for the analysis of
derivatives. It arises from one key property of the Black-Scholes-Merton
differential equation (12.15). This property is that the equation does not involve
any variable that is affected by the risk preferences of investors.

Unexpected Results

The prior art on the Black-Scholes framework teaches that even if risk premia were

included in an option pricing model, the resulting option values, across different strike prices,

would still be the same as under the risk-neutral Black-Scholes framework. An unexpected result

of Applicant's invention is that different option values are obtained for different option strike

prices and a single volatility input than from under the risk-neutral Black-Scholes framework.

This may be seen, for example, in figure 9 of the instant specification. Applicant's invention is

thus able to, at least in part, solve the volatility smile problem known in the art and illustrated in

figure 8 of Applicant's specification. This is an unexpected result from including risk premia in

an option pricing framework.

In addition, the prior art of analysing an option-theoretic model of the firm in a risk neutral world has found that when using realistic parameters the model predicted credit spreads are too low. Applicant's incorporation of risk premia into an option-theoretic model of the firm is able to produce higher credit spreads that more closely align with those observed in the market. This is an unexpected result from including risk premia in an option-theoretic model of the firm.

Defects with the Office's Rationale for Rejecting the Claims

In respect to the rejection of independent claims 165, 219 and 273, essential elements of Applicant's claims are not present in either Sandretto or Pang et al. These elements are that volatility, measured over discrete time, is a priced risk factor and that the price per unit of risk, for each priced risk factor, is the same for two or more securities issued by or referenced to the same underlying asset or firm. Furthermore, even if all of Applicant's features had been present in Sandretto and Pang, there would have been no motivation or suggestion to combine. The prior art teaches away from using risk premia in an option pricing model or an option-theoretic model of the firm and from treating total volatility as a priced risk factor. In addition, by introducing risk premia into an option pricing model or an option-theoretic model of the firm Applicant's invention produces unexpected results. In the former case the volatility smile can be explained and in the latter case more realistic credit spreads can be modelled.

In respect to the rejection of independent claims 209, 263 and 317, essential elements of Applicant's claims are not present in either Sandretto or Pang et al. These elements are application of an option-theoretic model of the firm and fitting such a model using risk parameters measured over discrete time. Furthermore, even if all of Applicant's features had been present in Sandretto and Pang, there would have been no motivation or suggestion to combine.

The Office then concludes that:

It would have been obvious to one of ordinary skill in the art at the time of invention to use volatility as taught by Pang et al. since the claimed invention is merely a combination of old elements and in the combination each element merely would have performed the same function as it did separately, and one of ordinary skill in the art would have recognized that the results of the combination were predictable.

Official Action, at 20.

        To support a combined-reference obviousness rejection, there must be a clearly articulated rationale for combining the prior art in a manner which meets the Applicant's claims. Indeed, as stated in MPEP § 2141, the key to supporting any rejection under Section 103 is "the clear articulation of the reason(s) why the claimed invention would have been obvious." Moreover, "rejections on obviousness cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." Exemplary rationales that may support a conclusion of obviousness, as set forth in MPEP 2141, include those noted below in the margin.[1] Of these enumerated rationales that may support an obviousness rejection, the only one that could arguably correspond to the Office's combination of Sandretto and Pang are, "(A) Combining prior art elements according to known methods to yield predictable results," and "(G) Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention." In this case, however, the Official Action offers a deficient justification of the rejection. The simple assertion of,

> It would have been obvious to one of ordinary skill in the art at the time of invention to use volatility as taught by Pang et al. since the claimed invention is merely a combination of old elements and in the combination each element merely would have performed the same function as it did separately, and one of ordinary skill in the art would have recognized that the results of the combination were predictable.

---

[1] (A) Combining prior art elements according to known methods to yield predictable results;
(B) Simple substitution of one known element for another to obtain predictable results;
(C) Use of known technique to improve similar devices (methods, or products) in the same way;
(D) Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;
(E) "Obvious to try" - choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;
(F) Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art;
(G) Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

falls short of the required showing set forth in the MPEP, i.e., a "clear articulation of the reason(s) why the claimed invention would have been obvious" and "articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." For example, under category (A), the office action is deficient because it lacks the necessary substantial (non-conclusory) showing of how Sandretto and Pang, when combined per claims 165, 209, 219, 263, 273, and 317, would yield predictable results, or what methods are known to perform such combining. Further, under category (G), the Official Action is lacking with respect to the required teaching, suggestion, or motivation that would have led one of ordinary skill to modify Sandretto or to combine Sandretto and Pang to arrive at the claimed invention. Thus, Applicant submits that a *prima facie* case of obviousness has not been established pursuant to MPEP 2141.

For these reasons, Applicant respectfully requests that the Office withdraw the rejections under 35 U.S.C. § 103(a). Applicant therefore respectfully requests reconsideration and withdrawal of the rejections of all claims that depend from the independent claims. Applicant reserves the right to challenge the rejection of any of those dependent claims in any future response that may be forthcoming.

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